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April 1, 2011

Delta Stewardship Council
980 9th St Suite 1500
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Dear Chairman Isenberg and Council Members,

Contra Costa Water District (CCWD) appreciates the opportunity to review the Delta Stewardship Council's First Staff Draft Delta Plan dated February 14, 2011, and we offer the comments below to aid in strengthening subsequent drafts of the Plan. Key issues for an effective plan include the following:

- **IMMEDIATE ACTIONS**
  The draft plan states that the final Delta Plan will include policies, strategies and performance measures for the first five years of Plan implementation (p. 2-4). These strategies should include immediate actions that will address the Delta ecosystem and water supply reliability issues in the Delta in the short term and continue to provide benefits over the long term. Recommended immediate actions include a comprehensive emergency preparedness plan, ecosystem restoration projects, fish screen pilot projects, and operable barriers to improve water supplies and water quality.

- **CONVEYANCE ALTERNATIVES**
  The key to increasing water supply reliability overall will be improving supply and reliability during droughts. The Bay Delta Conservation Plan studies show that a small isolated facility can produce 97 to 99% of the water provided by a large and largely unused facility. They also show that an isolated facility does little to improve water supplies during dry or critically dry years and therefore would not increase reliability over the long term. In short, a large isolated facility generates more conflict than water. CCWD believes alternative conveyance studies should focus on a conveyance system with a small intake in the North Delta. Further comments are provided in Section 2 of Attachment 1.

- **EXPANDED STORAGE**
  CALFED and the Delta Vision Strategic Plan recognized that the key to providing water supply reliability is additional surface water and groundwater storage. Increased storage will enable more water to be captured during wet conditions and stored for use during dry conditions. Note that this operational strategy is fundamentally different than the status quo; increased storage will not be driven by solely annual yield, but rather storage will be reserved more for drought conditions. Current conditions and long-term climate change dictate that new storage must focus on providing dry year supplies in order to reduce

reliance on the Delta. Currently, almost 80% of the water in the system is extracted in dry years, which are most associated with negative environmental consequences ("ecosystem crashes" since the 1970's have all coincided with dry years (1976-77 drought, 1985-1994 dry period and drought, 2001-2003 dry period, 2007-2010 drought). All recent independent scientific panels have emphasized the need to reduce reliance on the Delta, especially in dry years. Increased storage will be required to meet the co-equal goals. Further comments are provided in Section 2 of Attachment 1.

Our complete recommendations regarding the First Staff Draft Delta Plan are attached. CCWD looks forward to providing further input to the Delta Plan as the process continues. Please call me at (925) 688-8100 or Maureen Martin at (925) 688-8323 if you have any questions or concerns.

Sincerely,

Greg Gartrell
Assistant General Manager

GG/MM:wec

Attachments

Attachment 1
First Staff Draft Delta Plan
Contra Costa Water District's Comments

1 Immediate Actions

The draft Delta Plan establishes five distinct timeframes for implementation of milestones (p. 2-4). The initial five year block for implementing Delta Plan milestones is from 2012 through 2016. This section of the Delta Plan should include milestones for the initial timeframe; specifically, early actions identified in the legislation and Interim Delta Plan should be included in this section. CCWD offers the following language to be incorporated into the Delta Plan.

Suggested Language
p. 2-4 should read…
To provide long-term perspective and accommodate these goals, the Delta Plan will include policies, strategies and performance measures through 2100. Adoption of this time frame allows for reasonable staging of progress to achieve the coequal goals. The Delta Plan will include policies, strategies and performance measures for the following milestones:

Initial five years (2012-2016)
- *Develop and implement a strategy to appropriately engage participation of the federal agencies with responsibilities in the Delta (Section 85082)*
- *Review, adopt and implement a coordinated emergency response plan (Section 85309)*
- *Review and consider Delta flow criteria (Section 85084.5)*
- *Review and consider Bay Delta Conservation Plan (Section 85302)*
- *Implement levee improvements to protect key infrastructure*
- *Increase conservation of consumed water*
- *Increase water recycling especially in export areas where wastewater is not returned to Delta tributaries, the Delta, Suisun Marsh or Suisun Bay*
- *Improve treatment and water quality of wastewater discharges and runoff (urban and agricultural) to Delta tributaries, the Delta, Suisun Marsh and Suisun Bay*
- *Implement Two Gates Fish Protection Demonstration Project (Section 85085 (a))*
- *Evaluate effectiveness of, and implement a viable Threemile Slough barrier (Section 85085 (b))*
- *Implement Pilot Fish Screen Project at Clifton Court Forebay (Section 85085 (c))*
- *Implement Dutch Slough Tidal Restoration Project (Section 85085 (d)), including completion of Contra Costa Canal Encasement Project*
- *Implement 8,000 acres of habitat restoration projects, per the existing permit conditions*
- *Complete new storage feasibility studies (including environmental documents where required)*

Near Term (2017-2025)
- *Implement BDCP if included in Delta Plan*
- *Continue levee and emergency response planning and implementation*
- *Implement storage projects*
- *Continue conservation of consumed water*
- *Continue water recycling especially in export areas where wastewater is not returned to Delta tributaries, the Delta, Suisun Marsh or Suisun Bay*
- *Improve treatment and water quality of wastewater discharges and runoff (urban and agricultural) to Delta tributaries, the Delta, Suisun Marsh and Suisun Bay*

Mid-Century (2026 – 2050)

- *Implement additional habitat restoration programs*
- *Continue implementation of other programs (levees, emergency planning, ecosystem restoration, water quality and supply projects)*
- *Continue conservation of consumed water*
- *Continue water recycling especially in export areas where wastewater is not returned to Delta tributaries, the Delta, Suisun Marsh or Suisun Bay*
- *Improve treatment and water quality of wastewater discharges and runoff (urban and agricultural) to Delta tributaries, the Delta, Suisun Marsh and Suisun Bay*

Long Term (2051-2100)

- *Restore large areas of interconnected habitat (Section 85302(e))*

1.1 Emergency Preparedness

Minimizing water supply disruption following a catastrophic even such as an earthquake or flood should be a top priority. Legislation SBX 7-1 85309 requires the Department of Water Resources (DWR), in consultation with the Central Valley Flood Projection Board and the Army Corps of Engineers to prepare a proposal to coordinate flood and water supply operations and submit the proposal to the Council for consideration for incorporation into the Delta Plan. Coordinating operations among agencies will be critical to ensure water supply disruption is minimized after a catastrophic event. To their credit, the Metropolitan Water District of Southern California (MWDSC) has already started developing potential strategies involving the placement of temporary barriers within Delta channels following an earthquake. The State should also look at emergency response strategies that optimize reservoir operations in combination with temporary barriers to better flush salts from the Delta following levee failures. The Council should review the proposal once submitted by the above mentioned agencies and identify the key objectives, such as minimizing water supply disruption following a disaster, to be addressed to ensure effective emergency response in the Delta.

1.2 Ecosystem Restoration Projects

A number of ecosystem habitat improvements should be incorporated into the near-term actions of the Delta Plan. By incorporating these habitat improvement projects into the Delta Plan, the projects would contribute to species recovery in the near-term. Many projects have been proposed and advanced to various levels, but have not yet produced environmental documents. Any restoration projects included in the Delta Plan EIR should include full evaluation and disclosure of potential impacts, including impacts to water supplies and water quality so that adequate mitigation measures can be developed to reduce any impacts to insignificance.

There are a set of actions that can be taken now to start restoration of the Delta Ecosystem. These include:

- Remove non-native submerged and floating aquatic vegetation from Delta waterways. This would be an expansion of the current program.
- Improve the survival of outmigrating juvenile salmonids by using barriers to re-direct them away from channels in which survival is lower.
- Construct habitat projects with multiple benefits, including tidal marsh restoration, food web improvement, levee stability, and water quality improvement. The projects

that are currently believed to be high-potential restoration sites include Cache Slough, Liberty Island, Prospect Island, Little Holland Tract, Lindsey Slough, and Dutch Slough; some of these projects are already well into planning and environmental documentation.

1.3 Clifton Court Forebay Pilot Fish Screens

The latest salvage studies show that losses of Delta smelt in Clifton Court Forebay are far worse than imagined, with measured levels between 95% and 99.9% depending of the age of the smelt. This means that for every smelt found at the salvage facility, between 20 and 1,000 smelt are likely to have been lost in the Forebay. Fish screens at or near Clifton Court Forebay have the potential to quickly reduce the loss of fish by predation in the Clifton Court Forebay and through salvage operations, and to increase water supply reliability through changes in operational restrictions. A study of pilot-scale screens at Clifton Court Forebay is included in the Interim Delta Plan and the study is underway by a coalition of water agencies including Contra Costa Water District, Metropolitan Water District of Southern California, Zone 7 Water Agency, and Santa Clara Valley Water District. The study will be completed by May 2011 and if results are positive implementation should proceed. Even in the context of new conveyance, some South Delta pumping will be maintained and fish screens at Clifton Court Forebay will continue to be useful.

1.4 Delta Quality and Smelt Recovery/Franks Tract or Threemile Slough Barriers Pilot Project

This project could have eliminated or reduced the impact on export pumping in 2009 had it been in place because it would have reduced or eliminated the movement of smelt into an area where they were moved near the export pumps by the tides. A Franks Tract project (False River barrier) or Threemile Slough barrier can reduce Delta salinity intrusion in the fall and provide substantial fish benefits in winter and spring. Fish benefits include reduced entrainment of smelt at the export pumps by keeping the fish in the lower San Joaquin River (during periods when the smelt are located in this vicinity) and preventing their entry into Old River. In addition, the barrier will reduce seawater intrusion by keeping the seawater from entering Old River.

1.5 Reoperation of DCC

Alternative operation of the Delta Cross Channel (DCC) was proposed as part of the North/Central Delta Salmon Out-migration Study[1], coordinated by DWR. Based on the results of previous studies, the principal investigators hypothesize that the DCC gates could be operated with respect to the diel cycle to minimize fish movements into the central Delta while at the same time minimizing water quality impacts in the central Delta. These observations motivate the idea of closing the gates at night, presumably a period when salmon outmigrants are more vulnerable to entrainment into the DCC. Using this operational strategy, the DCC would be allowed to convey water into the central Delta during the day (and recreational boaters could move freely from the central to northern Delta through the DCC), where it would alleviate water quality concerns and allow increased exports over fully closed conditions[2] . The Delta Plan should incorporate

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[1] Study proposal and review documents are available on the DWR project website: http://baydeltaoffice.water.ca.gov/ndelta/salmon/index.cfm

[2] Burau, Jon, Aaron Blake, and Russell Perry. 2007. Sacramento/San Joaquin River Delta Regional

modifications to the DCC operations as a near-term action, designed with an integral monitoring component to evaluate the effects of the barrier operations on multiple species of concern. Reoperation of the DCC could have immediate benefits and provide valuable data to assist in the long-term operation of a through Delta or dual conveyance project.

2 Chapter 5: Manage Water Resources

The basis of Chapter 5 of the Delta Plan should be water supply reliability. Section 85211 of SBX 7 -1 states that the Delta Plan shall include performance measurements that will enable the council to track progress in meeting the objectives of the Delta Plan, including quantitative and measureable assessment of status and trends. A definition of water supply reliability should be provided in the Delta Plan and quantification of existing and desired future water supply reliability should be the key findings in this chapter. Improving water supply reliability means increasing the time between supply disruptions or decreasing the disparity between supply and demand over time. Two common definitions used in reliability engineering are provided below as examples:

$$\mathit{WaterSupply\ Reliability} = 1 - \frac{\mathit{Cumulative\ Time\ Demand\ Exceeds\ Supply}}{\mathit{Total\ Time}}$$ [3]

$$\mathit{Mean\ Time\ Between\ Failure} = \frac{\mathit{Cumulative\ Time\ Demand\ Exceeds\ Supply}}{\mathit{Total\ Number\ of\ Failures}}$$ [4]

The first step to determine water supply reliability is to determine the water supply. Historically, water development in California has been based on human demand rather than water supply. To meet the coequal goals, water supply and demands for all of the beneficial uses should be determined. The “Area of Origin” statutes and the Delta Protection Act (Water Code Section 12200 *et seq.*) were specifically enacted to protect in-basin and in-Delta water users. Once supply levels have been established, amount to meet demands of senior water right holders, in-basin users and fisheries should be quantified so that any remaining supply can be available for export.

Once the future water supply has been defined, a future water supply reliability goal can be established. The Delta Plan needs to make use of the existing studies and information to quantify existing or long term level of water supply reliability and establish a target goal for future reliability. Increasing water supply and decreasing demand must both be addressed in the Delta Plan to insure that water supply reliability is improved. Tools to improve water supply reliability include:

- Expanding storage
- improving conjunctive use and management
- increasing water use efficiency and conservation
- desalination
- conservation of consumed water

Salmon Outmigration Study Plan: Developing Understanding for Management and Restoration.

[3] Hashimoto, T., Loucks, D.P., Stedinger, J. 1982. Reliability, resilience and vulnerability for water resources system performance evaluation. Water Resources. Res 18(1), 14-20.
[4] http://en.wikipedia.org/wiki/Mean_time_between_failures

- recycling (especially in export areas, where wastewater is not returned to Delta tributaries, the Delta, Suisun Marsh or Suisun Bay)
- improving treatment and water quality of discharges to Delta tributaries, the Delta, Suisun Marsh or Suisun Bay.

The Delta Plan should include policy recommendations for each of the tools that will be used to increase water supply reliability.

2.1 State Water Project Reliability

It is important for the Delta Plan to acknowledge that water supply reliability is not interchangeable with 'full contract deliveries' and that reliability of water supply has varied over time. The Delta Plan finds that "the State Water Project's (SWP) long term average water delivery reliability has declined substantially in the past seven years" (p. 5-5). While this is true, the State Water Project has never been able to meet 100% of contract deliveries. This first became apparent in the 1976-77drought: under the original plans, the SWP was supposed to deliver 100% of contract amount *every* year except in a seven year drought, in which it was supposed to deliver 100% in 3 years, and 75% in the other 4. The 1977 critically dry year confirmed that the 5 million ac-ft of additional upstream storage envisioned by the State Water Plan would be needed to maintain the deliveries originally envisioned by the SWP.

The mismatch between expected and actual delivery capability of the SWP is in large part due to the failure to provide the storage that was and is known to be needed. Now, in critically dry years, the SWP deliveries can be expected to range from 4 to 20% depending on carryover storage and other operational requirements. Modeling results from all of the SWP reliability reports[5] indicate that under any conditions (all water year types, future, and existing), the SWP is rarely, if ever, able to deliver 100% of Table A amounts.

Suggested Language
p. 5-5 line 26 onward should read
The State Water Project (SWP) has published a bi-annual delivery reliability report since 2002. Water delivery reliability is dependent on water available, conveyance and demand. Most contractors Table A amounts reached the maximum in 1990. The long term average SWP delivery reliability has declined from 72% in 2002 to 60% in 2009. In critically dry years, such as 1976-1977, SWP delivery reliability is less than 20%. Low levels of SWP delivery reliability during drought conditions greatly reduce the long term delivery reliability. Decline in overall reliability is in large part due to a failure to build the storage known to be required for the SWPand the environment. In order to improve reliability for the SWP, and all of California, increases in drought supply and decreases in demand are needed.

2.2 Operations and Conveyance

Current Bay Delta Conservation Plan studies show that a 3,000 cfs tunnel provides nearly the same water supply benefit at little more than half the cost of a 15,000 cfs facility, yet the BDCP remains fixed on a 15,000 cfs facility. Regardless of facility size, the BDCP studies show that an isolated facility does not improve water supply during dry or critically dry years. The key to increasing water supply reliability overall will be

[5] The State Water Project Delivery Reliability Report. Department of Water Resources (2002, 2005, 2007, 2009).

improved supply and reliability during droughts, which will require expanded storage as described below in Section 2.3.

Suggested Language
p. 5-6 line 10 onward should read…
To be consistent with the policy of the state of California to reduce reliance on the Delta in meeting California's future water supply (Section 85021), a full range of conveyance capacities shall be considered. Regardless of size, any alternative conveyance and operation projects shall demonstrate improved water supply reliability as consistent with the coequal goals. Improving operations and conveyance such that more water can be diverted and stored during the wettest times for use during the driest times will be key to improving water supply reliability.

2.3 Expanded Storage

CALFED and the Delta Vision Strategic Plan indicated that the key to meeting the water demands while minimizing environmental impacts is increased storage. The description in the Delta Plan on p. 5-5 lines 38-45 could be enhanced by including the following example of how increasing storage can increase water supply reliability.

Suggested Addition
p. 5-6 line 3 onward
For example, the Contra Costa Water District's Los Vaqueros Reservoir is currently being expanded from 100,000 acre-feet to 160,000 acre-feet of storage. Contra Costa Water District (CCWD) relies on the Delta to meet nearly all of its demands. The expansion will enable the CCWD to maintain a high level of water supply reliability even during droughts. Modeling studies completed as part of the Los Vaqueros Reservoir Expansion Project Environmental Impact Study/Report indicate that the expanded reservoir will increase water supply reliability to 96% during a drought similar to 1976-1977 conditions. CCWD, DWR and Reclamation are continuing to study the feasibility of a further expansion of Los Vaqueros Reservoir to 275,000 acre feet for additional environmental and Bay Area water supply reliability benefits.

2.4 Urban Water Use Efficiency

The Delta Plan finds that "urban water residential use has not declined for the past 40 years" (p. 5-4). However, in CCWD's service area there has been a decline in residential water use despite an increase in population. Residential water demand in the CCWD service area was 89 TAF in 1989 and dropped to 82 TAF in 2009 while the residential population increased from 330,000 to over 500,000. Residential water use per capita in CCWD's service area has decreased by 33% over the last 20 years. In fact, average residential water use per capita in 2009 in CCWD's service area, 160 gallons per day per person, is the lowest CCWD has experienced, and that level continued in 2010. The Delta plan should acknowledge that residential per-capita water use has declined over the last due to increases in efficiency and conservation.

Urban water use is a small fraction of the total water use in California (~20%), and will further decrease with the implementation of the 20% per capita reduction required by SBX7-7. Some previous analyses have overestimated the amount of water that can be saved through conservation and efficiency given current practices and existing technology. For example, it is not uncommon to make estimates of potential conservation and potential recycling, and then add the two numbers; however, conserving and recycling the same water is not possible and the sum of the two double counts a substantial quantity of water.

Suggested Language
p. 5-4 line 27 onward should read…
Urban residential water use is approximately 20% of the total consumptive water used in California. Urban residential water use per capita has decreased over the last 20 years and will be further reduced as consistent with SBX 7-7, or 20% reduction by the year 2020. Reducing urban water use through conservation and efficiency initiatives will yield at least 1 MAF/yr of water by 2020. Reduced water demand will free up water in normal and wet ears that can be stored and used during dry times. Translating water use efficiency savings into specific water supply reliability benefits will depend on the water system, the level of savings, and variations in savings from one year to the next (California Water Plan Update 2009).

3 Chapter 6: Restore Delta Ecosystem

Water quality degradation has been a concern in the Delta for over a century, and it is a key factor to be addressed in order to restore the environment and protect drinking water from the Delta. The Delta Plan should contain all water quality issues in one chapter, combining the language currently contained in the restoration and water quality chapters. Any covered action, including habitat restoration projects, must protect drinking water quality as consistent with existing water quality regulations (D1641) and SBX 7-1 85022(d).

3.1 Salinity Variability

Increases in Delta salinity are a key concern for CCWD's drinking water supplies. CCWD has spent almost a billion dollars in the last 20 years to adapt to salinity at its Delta intakes and improve the quality of water delivered to its customers. Any changes to the Delta's salinity regime included in the Delta Plan must be explicitly stated and any impacts to drinking water quality must be minimized and any remaining impacts must be mitigated.

The Delta Plan's finding that "a healthy ecosystem may require a more natural salinity regime in parts of the Delta (p. 6-4)" must be clarified. CCWD supports the restoration of a more natural salinity regime to parts of the Delta; however, accomplishing this requires an accurate understanding of the natural salinity regime. Contrary to the ecosystem white paper developed as part of the Delta Plan and the basis of findings document, **<u>Delta salinity is not currently managed to be as low and uniform as possible year-round.</u>** In particular, fall salinity in the western Delta has increased substantially as a result of current water management. Figure 1 shows the actual measured monthly salinity at Collinsville compared to modeled salinity for unimpaired flow. In September, median salinity has increased to 4,000 µS/cm from approximately 2,500 µS/cm; in October median salinity has increased to 5,000 µS/cm from approximately 2,500 µS/cm; and in November median salinity has increased to over 5,000 µS/cm to 1,500 µS/cm. In fact, in all months from June through December, water in the western Delta is saltier than it would have been under unimpaired conditions; in the winter and spring, conditions at Collinsville are approximately similar. Establishing a more natural salinity regime will require a substantial amount of water, especially in spring. This could require additional storage, a substantial reduction in water use or both to achieve.

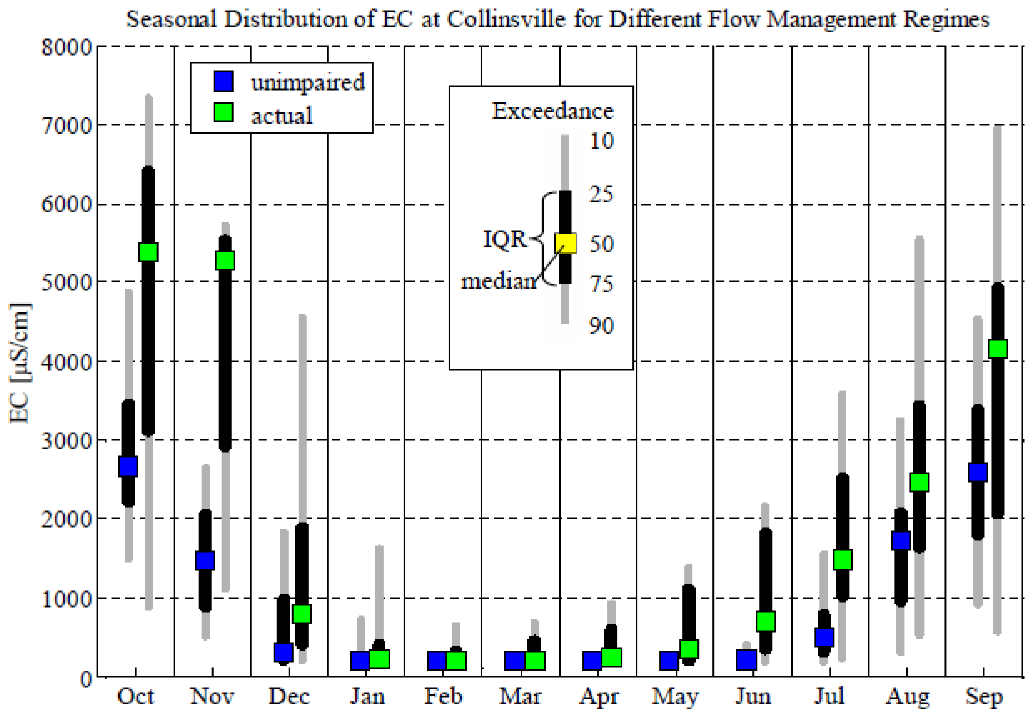

Figure 1 Unimpaired and actual salinity at Collinsville since 1993. Unimpaired salinity at Collinsville modeled using the G-model. The squares for each month represent the median value.

Suggested Language
P 6-4 line 37 onward should read…
Restoring a healthy ecosystem may require developing a more natural salinity regime in parts of the Delta. A report on Pelagic Organism Decline (POD, Baxter et al., 2008) indicated that reduced flow variability under the current water management conditions may have exacerbated the effects of predation on the population abundance of pelagic fish species in the Bay-Delta estuary. Native species of the Bay-Delta system adapted to the historical salinity conditions that occurred prior to large-scale water management practices and physical changes in the Delta. The historical record and published studies show the Delta is now managed at an average salinity level much higher than would have occurred under natural conditions (Enright and Culberson 2009, Contra Costa Water District 2010, Moyle et al 2010). Human activities, including channelization of the Delta, elimination of tidal marsh, and water diversions, have resulted in increased salinity levels in the Delta during the past 150 years. Seasonal and inter-annual variation in salinity has also been changed, largely as the result of reduced freshwater flows into the Delta. Peak salinity levels have shifted from the late summer (found in the 1920's prior to development of major reservoirs) to late fall, as outflow substantially has decreased in fall months, especially in the last 20 years. Annual freshening of Suisun Bay, which occurred for several months even in the driest years, no longer occurs in dry and critically dry springs. Magnitude and variation in salinity, such as the location of the 2 ppt isohaline or X2, are correlated with native species populations such as Delta smelt. As restoration projects move forward, any changes in the salinity regime desired to benefit specific species will also be consistent with existing drinking water quality regulations (D1641) and will protect human health as consistent with SBX 7-1 85022(d) .

Similarly on p.6-6 line 21 the Delta Plan finds that 'current flow regimes harm native species and encourage non-native species through their effects on turbidity, salinity aquatic plant communities and nutrients.' The Delta Plan references the State Water Resources Control Board's Development of flow criteria for the Sacramento-San Joaquin Delta ecosystem. During the development of the flow criteria, Dr. Peter Moyle recommend periodically increasing salinities in the upper estuary to 8 -10 ppt to reduce the abundance of invasive species such as *Egeria densa*. This level of salinity intrusion is NOT similar to the natural salinity regime and would not necessarily control *Egeria densa*. To achieve this type of salinity intrusion, Delta outflow would need to be effectively zero for at least 4 months. Turning off the water in California for four months is not a reasonable management option and the impacts to water quality would be similar to the most severe drought on record in 1924. Studies on this concept by the BDCP revealed attempting this level of outflow did not achieve the salinity levels required and posed flow issues to the significant detriment of salmon.

Furthermore, this level of salinity intrusion would not necessarily control *Egeria densa*. The Department of Boating and Waterways (DBW) began an *Egeria densa* treatment program in 2001 and has observed that *Egeria densa* actually spreads more quickly during drought conditions and is slower to spread during wet, fresh conditions.[6] Experimental studies on the effects of salinity on *Egeria densa* revealed that both root formation and growth decline with increasing salinity (Obrebski and Booth, 2003)[7]; however, even at 6 parts per thousand (ppt) salinity, the plant shoots continued to grow. Moyle suggested this same salinity regime to control *Egeria densa* during the State Water Resources Control Board Delta flow criteria informational proceedings. Attached is a copy of CCWD's information submitted to the State Water Resources Control Board in response to the same issue.

Moyle *et al*[8] state that there is a high degree of uncertainty in the specific salinity ranges and until a specific range can be confidently defined as a reasonable way to control *Egeria densa*, the Delta Plan should not consider this extremely unnatural salinity regime as the best available science and should not use it to guide Delta restoration policy.

Suggested Language
p. 6-6 line 24 onward
Flow is a major determinant of habitat and transport within the Delta. Timing and quantity of flow also determine water quality, temperature and turbidity which are all important to native species ecology. Flow modification is one of the few immediate actions available to improve conditions to benefit native species. Habitat restoration, contaminant and nutrient reduction, changes in diversions, control of invasive species, and flood plain inundation will also improve aquatic habitat favoring native species.

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[6] http://www.dbw.ca.gov/Environmental/Aquatic.aspx

[7] Experimental Studies of the Effects of Temperature, Salinity and Light Intensity on Growth of *Egeria densa*. Report to the California Department of Boating and Waterways, December 2003

[8] Moyle, Peter B, Lund, Jay R., Bennett, William A, & Fleenor, William E.(2010). Habitat Variability and Complexity in the Upper San Francisco Estuary. *San Francisco Estuary and Watershed Science*, 8(3).

3.2 Climate Change

The best available science should guide the Delta Plan's response to climate change. Some studies of climate change and seismic risk in the Delta have predicted imminent failure of the Delta and recommend abandoning the Delta forever[9] [10] [11]. A key assumption of these studies is the existing Delta channel geometry remains intact no matter how high sea level rises, in other words the channels never overflow into adjacent lands (including tidal marshes in the Bay). Using that assumption, increasing the depth of water increases tidal dispersion and therefore further increases salinity intrusion. In reality existing channels are not infinitely tall and overtopping and flooding will occur as a result of sea level rise or extensive levee damage. Tidal marshes will flood into new areas. Increasing the flooded area will change the tidal dynamics and alter the salinity regime in ways not yet studied. When areas are inundated, for example by flooding islands, the tidal energy can be dissipated, leading to a decrease in salinity intrusion. In some areas, the energy dissipation can be overcome by an increase in tidal prism and tidal flow, which could increase salinity intrusion. It is premature to draw conclusions as to what exactly will be the result until we know the response to sea level rise.

Recent BDCP modeling studies[12] have shown that island flooding due to sea level rise, levee failure, or both, will lead to a long term decrease in salinity intrusion. Immediately following a catastrophic levee failure with salinity in certain locations increases but after 4 months the Delta has recovered. Similarly, a recent study[13] suggests restoration of shallow water habitat will decrease salinity intrusion into the Delta. Restoring shallow water habitat within the Delta could be an effective mitigation strategy to minimize the impacts sea level rise could have on the Delta.

Suggested Language
p. 6-6 line 38 onward can include
Sea level rise and changes in California's precipitation are ongoing and will require changes in water resources management. The Delta will continue to be an important hub of water conveyance, transportation, agriculture and a thriving ecosystem. Adaptation and mitigation are both needed to minimize the impacts of climate change on the Delta. As climate change modeling and science continue to advance our knowledge, specific adaptation and mitigation strategies will be needed.

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[9] Mount, Jeffrey, & Twiss, Robert. (2005). Subsidence, sea level rise, and seismicity in the Sacramento-San Joaquin Delta. *San Francisco Estuary and Watershed Science,* 3(1).
[10] Lund, J., Hanak, E., Fleenor, W., Howitt, R., Mount, J., Moyle, P. (2007). *Envisioning Futures for the Sacramento San Joaquin Delta*. Public Policy Institute of California.
[11] Suddeth, Robyn J, Mount, Jeff, & Lund, Jay R. (2010). Levee Decisions and Sustainability for the Sacramento-San Joaquin Delta. *San Francisco Estuary and Watershed Science,* 8(2)
[12] "Potential Impacts of Large Scale Delta Levee Failure on BDCP Restoration and Intake Investments". RMA Presentation at the BDCP Steering Committee Meeting July 29th 2010.
[13] Enright, Chris. (2010). Hydrodynamics and transport processes on the historical landscape: geomorphic control of functional complexity and implications for restoration. Bay Delta Science Conference Presentation.

4 Chapter 7: Improve Water Quality

As noted above CCWD thinks it is appropriate to contain all water quality references in this chapter, including those previously discussed in the ecosystem restoration chapter. There are no references given to support the general findings, supporting references should be included in subsequent drafts of the Delta Plan.

4.1 Salinity Management

Salinity levels in the Delta have long been a concern and salinity management deserves more attention in the Delta Plan. The two primary sources of salinity in the Delta are seawater intrusion and agricultural drainage. The contribution of salt from each of those processes to the overall salinity varies by season and by location within the Delta. For example, in the western Delta near Antioch seawater intrusion is the primary source of salinity whereas salinity near Stockton is often largely due to agricultural runoff. CCWD has provided additional language below for your consideration.

Suggested Language

Findings

WESTERN DELTA SALINITY HAS INCREASED OVER THE LAST 150 YEARS AND WILL CONTINUE TO DO SO IN THE ABSENCE OF RESTORING WATER QUALITY TO PROTECT DRINKING WATER, AGRICULTURAL AND ENVIRONMENTAL BENEFICIAL USES. *The historical record and published studies show the Delta is now managed at an average salinity level much higher than would have occurred under natural conditions (Enright and Culberson 2009, Contra Costa Water District 2010, Moyle et al 2010). Prior to European settlement, Delta salinity was primarily due to seawater intrusion and the extent of intrusion depended on the amount of freshwater flowing out of the Delta. Since the late 1880s, major anthropogenic modifications to the Delta that affect salinity intrusion can be classified into two categories: physical modifications of the landscape (e.g., removal of tidal marsh, separation of natural floodplains from valley rivers, construction of permanent artificial river channels, and land-use changes) and water management activities (e.g. diversion of water for direct agriculture, municipal, or industrial use, and reservoir storage and release operations). Salinity has been and continues to be managed by both engineered solutions and by regulations. Engineered solutions include rock barriers and gates such as the Delta Cross Channel. Salinity regulations became prominent in 1978 when the Water Quality Control Plan and State Water Resources Control Board (SWRCB) Decision 1485 established water quality requirements at key locations to protect agriculture, municipal and industrial uses. The Bay-Delta Accord of 1994 and subsequent SWRCB Water Rights Decision 1641 have enhanced salinity regulations to protect fisheries. Despite many salinity management strategies over the past century, increasing salinity remains a key concern that must be addressed in order to protect and restore the beneficial uses of the Delta. Any covered action, including habitat restoration projects or changes in conveyance, must protect water quality as consistent with existing water quality regulations (D1641), SBX 7-1 85022(d) and 85302(e)6.*

As noted above, the Delta Plan provides a reference to Moyle. *et al* 2010[14] to support the salinity variability finding, however this paper contains contradicting information about flow and salinity variability so it is not clear what the Delta Plan is recommending by citing this reference. Moyle *et al* recommend increasing flows from the San Joaquin and

[14] Moyle, Peter B, Lund, Jay R., Bennett, William A, & Fleenor, William E.(2010). Habitat Variability and Complexity in the Upper San Francisco Estuary. *San Francisco Estuary and Watershed Science*, 8(3).

Sacramento Rivers that would improve water quality, increase migration rates of juvenile salmon through the Delta, reduce entrainment, increase inflows to the Delta during critical periods and improve habitat in the lower river through flooding of shallow areas. Increasing flows above current levels would decrease Delta salinity. However, in the same paper Moyle et al also recommend periodically increasing salinities in the upper estuary to 8 -10 ppt to reduce the abundance of invasive species such as *Egeria densa*. <u>This level of salinity intrusion is NOT similar to the natural salinity regime and would not necessarily control *Egeria densa*</u>. CCWD would like to offer the following language addressing salinity management and ecosystem response to salinity variation.

Suggested Language
p. 3 of Water Quality Findings regarding Ecosystem Restoration
RESTORING A HEALTHY ECOSYSTEM MAY REQUIRE DEVELOPING A MORE NATURAL SALINITY REGIME IN PARTS OF THE DELTA. *A report on Pelagic Organism Decline (POD, Baxter et al., 2008) indicated that reduced flow variability under the current water management conditions may have exacerbated the effects of predation on the population abundance of pelagic fish species in the Bay-Delta estuary. Native species of the Bay-Delta system adapted to the historical salinity conditions that occurred prior to large-scale water management practices and physical changes in the Delta. The historical record and published studies show the Delta is now managed at an average salinity level much higher than would have occurred under natural conditions (Enright and Culberson 2009, Contra Costa Water District 2010, Moyle et al 2010). Human activities, including channelization of the Delta, elimination of tidal marsh, and water diversions, have resulted in increased salinity levels in the Delta during the past 150 years. Seasonal and inter-annual variation in salinity has also been changed, largely as the result of reduced freshwater flows into the Delta. Peak salinity levels have shifted from the late summer (found in the 1920's prior to development of major reservoirs) to late fall, as outflow substantially has decreased in fall months, especially in the last 20 years. Annual freshening of Suisun Bay, which occurred for several months even in the driest years, no longer occurs in dry and critically dry springs. Magnitude and variation in salinity, such as the location of the 2 ppt isohaline or X2, are correlated with native species populations such as Delta smelt. As restoration projects move forward, any changes in the salinity regime desired to benefit specific species will also be consistent with existing drinking water quality regulations (D1641) and will protect human health as consistent with SBX 7-1 85022(d) .*

5 Chapter 8: Reduce Risks to People, Property, and State Interests in the Delta

The Delta Plan should acknowledge the seismic and flood risk for all Delta water infrastructure, including the infrastructure that serves the in-Delta communities. On page 8-6 the Delta Plan finds that "the Mokelumne Aqueduct, which crosses the Delta, is a major source of water for the East Bay". Other water supply infrastructure in the Delta should be noted as well: Contra Costa Water District's Rock Slough Intake, Mallard Slough Intake, Middle River Intake, Old River Intake, and the Contra Costa Canal; the North Bay Aqueduct; and the City of Antioch's intake. Including a description of, and a commitment to reduce the risks to, infrastructure that serves the Delta communities is consistent with the intent of SBX 7-1 to protect the Delta as a place.

Suggested Language
p. 8-6 the findings on lines 14 and 31 can be combined…
Water distribution systems within and crossing the Delta are critical to the State's water supply. The Delta is the hub of California's two largest water distribution systems, the federal Central Valley Project and State Water Project. Other urban water supply infrastructure in the Delta includes the Mokelumne Aqueduct, Contra Costa Water District Intakes (Mallard Slough, Old River, and Middle River), the Contra Costa Canal, the North Bay Aqueduct and the City of Antioch's intake. At least 7,000 other permitted water diverters have developed water supplies from the watershed feeding the Bay-Delta estuary. The Delta provides drinking water to approximately 23 million people plus the 1.3 million people served by the Mokelumne Aqueduct that crosses the Delta.

As required by SBX 7-1 Section 85306, the Delta Plan shall include recommended priorities for state investments in levee operation, maintenance, and improvements in the Delta. The Council has been reluctant to develop a priority list of levees but it must be done to improve levee conditions and reduce risk in the Delta. CCWD offers the following suggestions for levee priorities.

Suggested Top Priority Levees
1) *Urban Levees*
2) *Levees protecting water supply infrastructure (Sherman Island, Victoria Island, Orwood Tract, Woodward Island, Jones Tract, Roberts Island)*
3) *Levees protecting western Delta islands*
4) *Levees protecting other infrastructure*

6 Chapter 11: Finance Plan to Support Coequal Goals

The Delta Plan should contain a financing plan that recognizes that there is a broad base of beneficiaries in the Delta, and project costs should be assigned appropriately to all beneficiaries. New water conveyance infrastructure should be funded by the direct beneficiaries, i.e. the water agencies that receive water through the new conveyance. Improvements with more widespread benefits, such as Delta levee improvements and emergency preparedness, should be funded by all who receive the benefits, with recognition that this includes state funding for broad public benefits. Those who receive direct benefits could include: the general public, drinking water suppliers, agricultural industry, Delta communities, transportation, in-Delta infrastructure, waste water dischargers, recreation and tourism industry, commercial fishing industry, and the building industry. Credit against costs should be included for those who currently contribute to restoration (for example, contributors to the Central Valley Project Improvement Act Restoration Fund) or those who have fully mitigated their impacts to fisheries.

Attachment 2
Contra Costa Water District Submittal to State Water Resources Control Board
Delta Flow Criteria Informational Proceeding

Delta Flow Criteria Informational Proceeding

Before the

State Water Resources Control Board

Scheduled to Commence
March 22, 2010

Questions on Written Testimony

Submitted on behalf of

Contra Costa Water District
P.O. Box H2O
Concord, CA 94524

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Delta Flow Criteria Informational Proceeding

Question for State Water Board's "Delta Environmental Flows Group of Experts"

Suppression of *Egeria densa* by reducing Delta outflow and increasing salinity intrusion

CCWD respectfully submits the following information and requests that, in light of this information, the State Water Board's expert witness group discuss and reconsider the recommendation for flows to suppress *Egeria densa* in the State Water Board's staff exhibit "On Developing Prescriptions for Freshwater Flows to Sustain Desirable Fishes in the Sacramento-San Joaquin Delta" by William E. Fleenor, William A. Bennett, Peter B. Moyle, and Jay R. Lund (hereafter "authors").

The authors recommend an experimental Delta outflow to "allow the western and parts of the central Delta to become much more saline to suppress the invasive Brazilian waterweed, *Egeria densa*". However, this approach is unlikely to meet the desired goal of suppressing growth of *Egeria densa* for the following reasons: (1) the recommended flows would not increase Delta salinity; (2) even extreme salinity intrusion such as that experienced during the drought of 1924 would be unlikely to significantly reduce the distribution of *Egeria densa*; (3) for nearly 2,500 years before the droughts of the 1920's and 1930's, native Delta species thrived in a relatively fresh system; (4) to increase salinity in the central Delta to the 10 ppt necessary to begin suppression of *Egeria densa*, Delta outflow would need to be reduced for 4 to 5 months to levels that create a net reverse flow from San Francisco Bay to the Delta; and (5) such reduced Delta outflow levels to increase salinity intrusion would likely encourage other harmful invasive species and cause additional harm to the ecosystem.

1. The recommended flows would not increase Delta salinity

The recommended flow (8,000 cfs in July and August during the driest 3 out of 10 years) is actually much greater than the recently observed daily Delta outflow (Figure 1). From 1995 though 2009, in dry and critically dry water years, Delta outflow during July and August averaged just 4,300 cfs and exceed the recommended flow of 8,000 cfs on 2 days (out of 310 days). In fact, during all water year types from 1995 through 2009 (including 9 above normal and wet water years), Delta outflow exceeded the recommended dry year flow of 8,000 cfs just 42% of the time.

The method used to develop the flow recommendation (i.e. recreation of unimpaired hydrology during dry years) is likely valid for providing conditions to which natives aquatic species evolved and may dominate over invasive species. However, substantial upstream development and water use has significantly reduced summer Delta outflow, such that the current summer outflows are significantly below unimpaired conditions. Thus, the recommended outflow would freshen the western and central Delta rather than making the region more saline; therefore, the recommended flow would not meet the desired goal of suppressing *Egeria densa* growth. It could, however, discourage the invasive overbite clam (*Corbula amurensis*), which is found to thrive in low flow (high salinity) conditions found in dry years.

2. Even extreme salinity intrusion experienced during the drought of 1924 would be unlikely to significantly impact the distribution of *Egeria densa*

Experimental studies on the effects of salinity on *Egeria densa* revealed that both root formation and growth decline with increasing salinity (Obrebski and Booth, 2003); however, even at 6 parts per thousand (ppt) salinity, the plant shoots continued to grow, with an average growth of 10% to 40% over 18 days, depending on temperature (Figure 2). Hauenstein and Ramirez (1986) found no growth of roots or stems at salinity greater than 10 ppt.

Egeria densa is present throughout the Delta (Figure 3), with dense patches in regions far removed from the San Francisco Bay, such as within White Slough (in the eastern Delta, north of Empire Tract and Kings Island) and Old River (in the south Delta around Coney Island). Even during the extreme drought of 1924,[1] salinity in White Slough near Kings Island and Old River near Coney Island peaked[2] at approximately 3.0 ppt and 1.5 ppt (DPW, 1931), respectively, at levels far below the salinity tolerance of *Egeria densa*. During the 1924 drought, salinity peaked on False River near Franks Tract at approximately 7.5 ppt for a single day and remained above 5.5 ppt for approximately 1 month (DPW, 1931). Based on the experiments by Obrebski and Booth (2003), if *Egeria densa* had been present in 1924, this location may have experienced inhibited growth, but salinity levels were unlikely to have eradicated plants in the area.

3. For nearly 2,500 years before the droughts of the 1920's and 1930's, native Delta species thrived in a relatively fresh system.

As discussed in CCWD Exhibit 6, salinity intrusion during the drought in the 1920's and 1930's had been exacerbated by anthropogenic changes, including reclamation of Delta islands, straightening and deepening of the Sacramento River near Decker Island, and diversion of water upstream of the Delta to irrigate over 4 million acres of crops. An investigation by the state (DPW, 1931) declared that "[d]uring certain years of the thirteen-year period, 1917 to 1929, the extent of saline invasion into the Sacramento-San Joaquin Delta has been greater than ever before known to have occurred."

These observations were confirmed by plant pollen studies from sediment cores in Suisun Bay and the western Delta, revealing that salinity increased abruptly about 100 years ago, reaching or exceeding salinity levels at any other time in the last 2,500 years. Based on sediment cores at Browns Island, the western Delta was predominately a freshwater system for the entire length of record (approximately 2,500 years), until the early 1900's. Although salinity intrusion is evident in Suisun Bay at Roe Island during earlier long drought periods, salinity did not affect the western Delta to the same degree. This suggests a change in spatial salinity gradient characteristics, and is possibly due to the effect on salinity intrusion of the vast tidal marshes that existed in the Delta until the early 20th Century (see Figure 2-5 in CCWD Exhibit 6).

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[1] Total annual unimpaired net Delta outflow for water year 1924 is the second lowest on record (1921-2003). Hydrological reconstruction from tree rings (Meko *et al.*, 2001) indicates that water year 1924 was the worst single year drought in nearly 350 years, covering the reconstructed time period (1629-1977).

[2] Salinity measurements were taken from a surface sample, usually at 2 hours after high tide, approximating the daily maximum salinity. Sampling locations are indicated by blue diamonds in Figure 3.

4. To increase salinity in the central Delta to the 10 ppt necessary to begin suppression of *Egeria densa*, Delta outflow would need to be substantially reduced for 4 to 5 months to levels that create a net reverse flow from San Francisco Bay to the Delta.

Estimates of daily Delta outflow are available from the Department of Water Resources' Dayflow model[3] from October 1929 through October 2009. Water year 1931 had similar unimpaired hydrology to the drought of 1924, but water year 1931 was also proceeded by two dry water years and was impacted by seven additional years of upstream development and increased diversions. For example, in 1924, capacity of reservoirs in the Sacramento and San Joaquin river basins totaled approximately 1.5 million acre feet (MAF); by 1931, reservoir capacity in the basins exceeded 3.6 MAF (DWR, 1993).

In 1931, net Delta outflow was negative (on average, water from San Francisco Bay was flowing into the Delta) for 4 months, from early June through the first week in September (with the exception of a few days in mid-June), such that the average outflow for June through September was -1,000 cfs (eastward). During this period, unimpaired outflow averaged +3,900 cfs (seaward); salinity intrusion was exacerbated by the nearly 5,000 cfs reduction in outflow due to upstream and within Delta diversions.

In 1931, salinity peaked in September and began decreasing when net Delta outflow returned to the natural, seaward direction. Salinity peaked around 13 ppt near Franks Tract, while on White Slough near Empire Tract and Old River near Coney Island peaked near 4.5 ppt and 3.0 ppt, respectively (DPW, 1931). If *Egeria densa* had been present in 1931, salinity may have caused necrosis in some of the plants near Franks Tract. However, dense growth of *Egeria densa* within Franks Tract (typical in September of dry years) reduces lateral mixing such that salinity levels would need to remain elevated for weeks to months in the vicinity of Franks Tract to mix into the dense stands of vegetation. Given the widespread growth of *Egeria densa* within the Delta, *Egeria densa* is likely to reinvade any areas potentially affected by elevated salinity. For instance, following herbicide treatments to control *Egeria densa*, some stems that became chlorotic or exhibited defoliation, later exhibited regrowth (Ruch *et al.*, 2006).

To increase salinity in the central Delta to 10 ppt in an attempt to suppress *Egeria densa*, Delta outflow would need to be reduced to near zero or negative (reverse flow) conditions for 4 to 5 months.

5. Reduced Delta outflow to increase salinity intrusion could encourage invasive species and cause other harm to the ecosystem.

Since salinity intrusion during the drought of the 1920's and 1930's was increased due to anthropogenic activities, it seems inappropriate to assume native estuarine species would prefer this manipulation of the salinity regime. In fact, increased salinity intrusion may trigger unintentional consequences that are detrimental to the ecosystem. In response to increased salinity intrusion, any organisms that have preferential salinity ranges such as delta smelt may move eastward, into the Delta, which may become increasingly inhospitable. Increased residence time will increase the potential for accumulation of toxics, increase nutrient

[3] http://www.water.ca.gov/dayflow/

concentrations, and raise the water temperature, which, in turn, will affect algal growth patterns. Certain algal species (e.g. *microcystis*) are known to be detrimental to sensitive aquatic species.

In addition, increased salinity may allow the overbite clam (*Corbula amurensis*) to expand its range, potentially shrinking the range of the Asiatic freshwater clam (*Corbicula fluminea*). The overbite clam has a higher food uptake rate than the Asiatic freshwater clam; Asiatic freshwater clams did not historically suppress annual spring-summer phytoplankton blooms throughout the upper estuary like overbite clams do in the brackish water zone today (Thompson, 2007). The dynamics of clam-phytoplankton interactions under different salinity regimes are not currently predictable. Therefore, the food web responses of fishes feeding on clams or competing with them for food are likewise not currently predictable.

Finally, if elevated salinity does exterminate large areas of *Egeria densa*, depending on the rate of necrosis and the movement of detritus, dissolved oxygen levels could be depleted with anoxic conditions in the sediments and release of toxic metals. This scenario is more likely to occur in areas where the beds of submerged vegetation have less mixing with the adjacent open water areas (e.g. Franks Tract during the summer and fall seasons).

In summary, based on experiments on salinity tolerance, even if an artificially high level of salinity is recreated in the present Delta, the distribution of *Egeria densa* is not likely to be significantly reduced, yet the reduction in Delta outflow necessary to increase salinity may adversely affect the ecosystem. Therefore, salinity intrusion is not an effective method to control *Egeria densa*.

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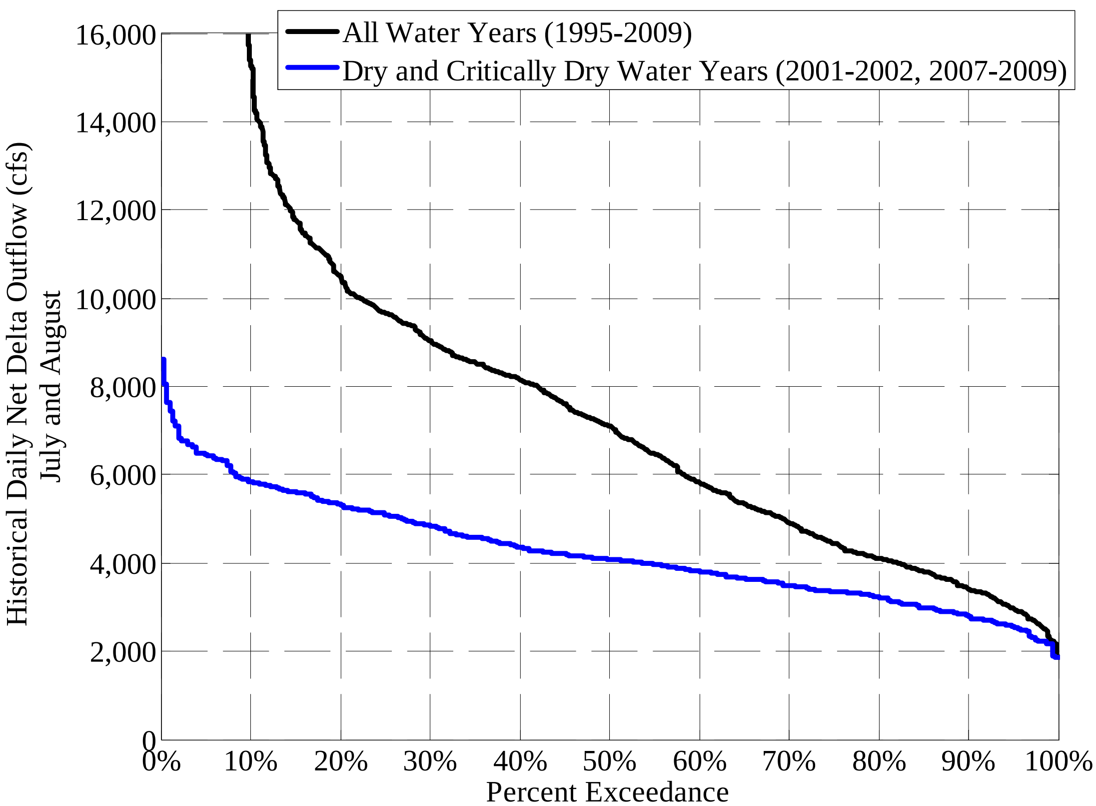

Figure 1 – Historical daily Delta outflow during July and August (1995 through 2009)

Data from the Dayflow model (http://www.water.ca.gov/dayflow/)

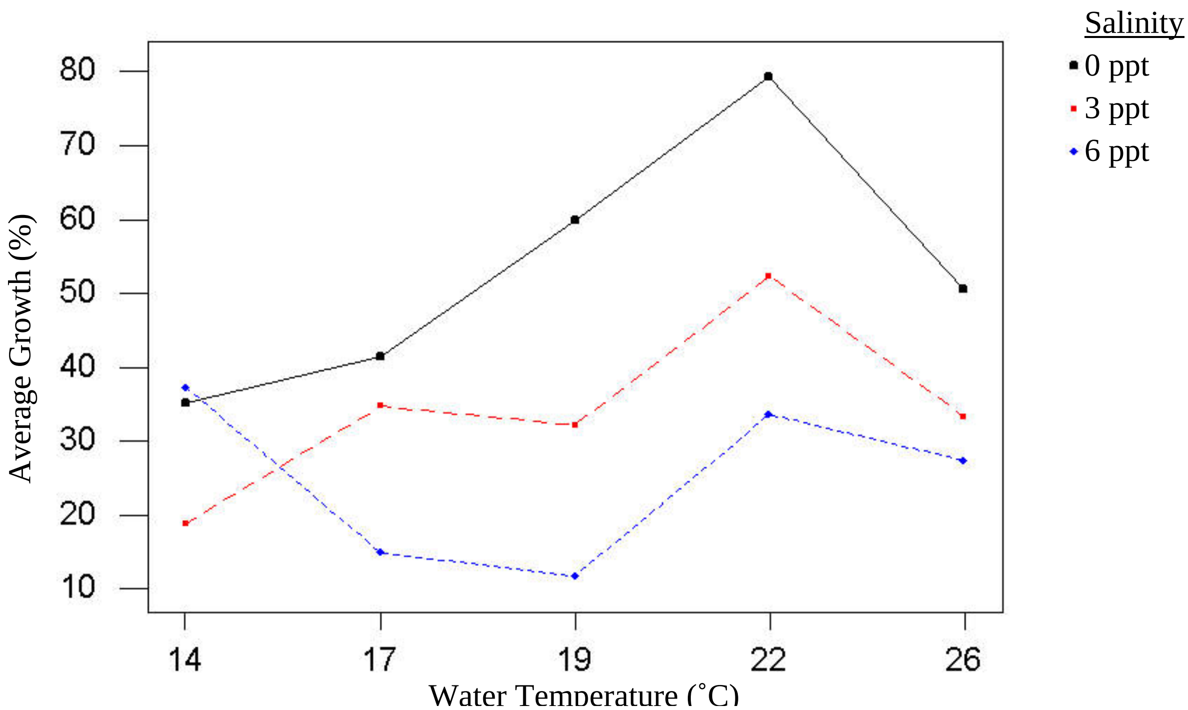

Figure 2 – Effects of Temperature and Salinity on growth of *Egeria densa*

Figure adapted from Figure 3 in Obrebski and Booth (2003)

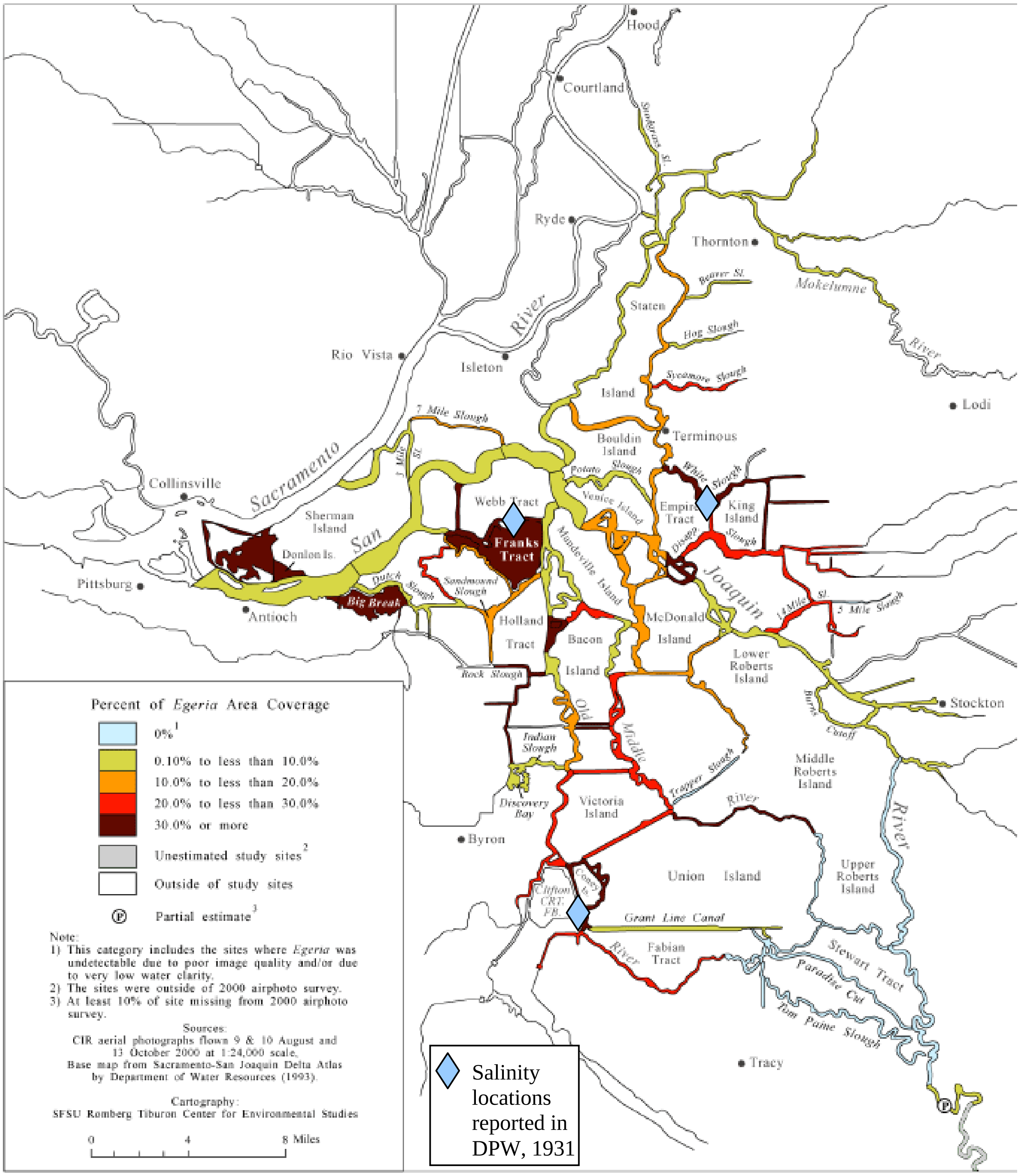

Figure 3 – Areal Coverage of *Egeria densa*, 2000

Created by P.G. Foschi et al., SFSU Romberg Tiburon Center, cartographer: M. Odaya. Locations of salinity measurements reported from DPW (1931) are indicated with blue diamonds.

Question for Dr. Gregory Gartrell, Contra Costa Water District

Old and Middle River flow to prevent entrainment at the export facilities

Dr. Greg Gartrell provided information to the National Research Council (NRC) Committee on Sustainable Water and Environmental Management (Technical Memorandum dated January 25, 2010) regarding the use of Old and Middle River flow to prevent salvage at the export facilities and regarding the information provided by various parties to both the NRC Committee and the SWRCB in this proceeding. Please discuss the utility of using net flow on Old and Middle River flow as a criterion for internal Delta hydrodynamics and the various proposals regarding the relationships between salvage and flow.